GLY 4734 Changing Coastlines

Florida International University

Department of Earth and Environment

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Reference Text on Reserve at Green Library that Includes Required Articles:

- R4: Chapter 20, Case Study of Constanta, Romania, p. 402-411.

On-Line Articles:

- Wave-Generated Energy in Israel and Micronesia (see www.sde-energy.com).
- Case Study of Sylt Island, German Bight (www.iczm.de/sylt.pdf).

Discussion Papers (Available in DropBox):

- D4: Sand Thieves of Long Island’s South Shore of New York, 1997, Shore and Beach,
- V. 65, p. 4-12.
- D7: Time Frames for Barrier Island Migration, 1987, Shore and Beach, V. 55, p. 82-86.
- D10: Economic and Social Values of Beach Recreation on the Gold Coast of Australia.

**Literature Review**: You will be asked to locate other relevant articles for some classes, which you will summarize in bullet points and discuss in class.

**Course Justification**:

Eighty percent of the world’s population resides in the coastal zone, and beachfront property is some of the most desirable and expensive real estate in the United States and indeed worldwide. This course involves the evolution of coastal landscapes with emphasis on shoreline changes and development patterns. About 70 percent of the world’s beaches are presently eroding; the number approaches 90 percent for the better-studied United States sandy coastlines. At the same time there is a shoreward migration of the population and increased development—this is the classic definition of a collision course.

In coastal regions worldwide, settlements, agriculture, industry, transportation, and tourism thrive. Human impact via utilization of the coastal zone for land reclamation, extraction of natural resources, construction of structures such as river dams and inlet jetties, can impact natural processes and limit sediment supply, resulting in profound impacts on the shore, such as accelerating coastal erosion and land loss. Minimizing human impacts depends upon a clear understanding of natural and anthropogenic processes as well as social norms, economic constraints and pressures for continued urbanization.

Coastal development in South Florida has been booming in the past few decades as mid- and high-rise buildings replace residential houses and small motels because of the tremendous demand and high value of this property. Such rapid growth in South Florida is being replicated along much of the developed world’s shorelines, such the Mediterranean coast of Spain and
France, and indeed in many developing countries, including Brazil, China, and Malaysia. The response to coastal erosion as driven by storm impacts, sea level rise and other factors has often been to harden the shore with coastal engineering structures, especially seawalls, groins and jetties. Such attempts to protect beachfront development and infrastructure, especially roads and utilities, have sometimes led to the loss of the beach itself. In the United States, the trend is away from these massive concrete structures and toward a soft solution—beach nourishment.

Beach nourishment is considered by many coastal communities as their salvation to the onslaught of storms and progressive coastal erosion. Generally sand is pumped from offshore areas to nourish the beach at a cost of millions of dollars per mile of shore with 65 percent of the cost borne by taxpayers through these massive U.S. Army Corps of Engineers projects. While some projects have been very successful, especially the Miami Beach project that cost $65 million to restore 10 miles of beach in the early 1980s, others have lasted only a few years or until the advent of the next coastal storm. What is not realized by the general public and many government officials is that the artificially-built beach is sacrificial—beach nourishment only treats the symptom (e.g., beach retreat); it does not cure the disease (causes of erosion). Therefore, beach nourishment merely sets back the erosion clock and buys beachfront areas some time that varies greatly according to local, regional and global factors.

Understanding the causes of coastal erosion and various strategies for mitigation of their impacts on human development and the natural environment requires an understanding of their inter-disciplinary dimensions. The nature of this problem spans the technical aspects to the economic, political and legal challenges. This course examines coastal erosion and development patterns on a worldwide basis and assesses the global and site-specific susceptibilities and differing approaches for mitigation. Some areas are especially prone to erosion, such as Louisiana—the erosion hot spot in the United States with loss rates as high as 50 feet per year. Elsewhere erosion rates are fairly low, such as East Hampton, New York where rates average about a foot per year, probably because of the onshore flow of sediments left behind from the last Ice Age that formed Long Island itself. The cost to maintain sandy beaches, which are the world’s most popular recreational areas and some of the most expensive real estate, is high and likely to increase in future years in response to global warming and attendant rising sea levels.

The United States is the world leader in coastal science and engineering—we are on the forefront of the issues involving coastal erosion and mitigation as well as litigation that are now problematic or being considered in other developed countries and underdeveloped countries.
Global Learning Course Outcomes:

Global Awareness— Students will be able to demonstrate an understanding of the interconnection of coastal erosion and protection strategies on a global basis, that these problems have no national borders, and that these problems are affected by geological, meteorological and oceanographic factors as well as socioeconomic, technological and cultural conditions.

Global Perspective— Students will be able to conduct analyses of the impact and mitigation of coastal erosion in a site-specific and global context, and the extent to which multiple factors, such as technical approaches, economics, and social norms, contribute to or help solve the problem.

Global Engagement— Students will collaborate in groups to devise solutions to problems of mitigating coastal erosion, which are appropriate within the framework of technological, economic, legal and societal factors at local, regional, national and global levels.

Active Learning Strategies (please bring your laptop computer to class):

Students will participate in a number of activities including:

- Class Discussions
- Discussion Groups
- Socratic Circles
- Class Debate
- Class Group Power Point presentation
- Field Trip (highly recommended)
- Video Production (extra credit)

Co-Curricular Activities:

Students will be able to participate in various on and off-campus co-curricular activities, which are available at goglobal.fiu.edu. Documented attendance of at least three of these activities and submission of a three-page summary of the activities (one page per activity) will count as extra credit in the course.
Grading Policy:

Grades will be based on the following scores:

- Class discussions, presentations and debates 20%
- Weekly write-ups of assigned readings and literature review (use bullet points for main points and critical questions; limit one page per assignment with second page for any references) 20%
- Mid-term exam 20%
- Final exam 20%
- Attendance 10%
- Team peer assessment 10%
- Video project and/or co-curricular activities 5% (Extra Credit)

Grading Scale:

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<thead>
<tr>
<th>Grade</th>
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<tr>
<td>A</td>
<td>93-100</td>
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Class Schedule

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<tr>
<th>Date (2014)</th>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td>January 6</td>
<td>Ground Rules and Introduction to Course</td>
<td>Syllabus</td>
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Engaging Question: Is conflict at the shore inevitable in response to coastal erosion and continued development?

Learning Activity: Power Point Presentation

Class discussion of beaches—the most dynamic developed
landscape on earth and the socioeconomic implications of continued urbanization and global change. (Global Awareness and Perspective)

Assignment: One page summary each of Chapter 5 in textbook and literature review on hurricane modification to reduce their impacts, especially regarding the recent proposition by billionaire Bill Gates.

Hurricanes, which are called cyclones in the Indian Ocean and typhoons in the Pacific Ocean, impact many nations worldwide such as the Philippines.

January 13 Causes of Beach Erosion: Weather Systems Chapter 5 & Lit. Review

Engaging Question: Can hurricanes be tamed, and if so, what are the environmental, political and legal ramifications?

Group discussion of the pros and cons of storm modification projects, such as NOAA’s Project Stormfury. (Global Awareness and Perspective)

Learning Activity: Power Point Presentation

Assignment: One page summary each of Chapter 6 in book and review of energy generation from waves in Israel and Micronesia (available on-line).

January 20 No Class

January 27 Causes of Beach Erosion: Waves and Currents Chapter 6 & On-Line Articles on Israel and Micronesia
Learning Activity: Power Point Presentation

Class discussion of how waves act like light by bending and focusing energy in shallow water and how these properties could possibly be used to reduce coastal erosion and even generate electricity. (Global Awareness and Perspective)

Assignment: One page summary each of Chapter 4 in book and D1 article on Gambia.

February 3 Causes of Beach Erosion: Sea Level Rise Chapter 4 & Gambia article

Engaging Question: Is rising sea level the “dipstick” of climate change?

Learning Activity: Power Point Presentation

Group discussion of what causes ocean levels to rise globally in response to climate warming and how it is “hard wired” to coastal erosion. (Global Awareness and Perspective)

Engaging Question: What can be done to stem the rising tide and prevent wholesale losses of beaches worldwide? (Global Engagement)

Assignment: One page summary each of Chapter 21 and R1 chapter on Europe.

February 10 Causes of Beach Erosion: Human Modification and Stabilization Chapter 21 & Article on Europe

Engaging Question: Consider the benefits vs. the economic and environmental costs of coastal stabilization: is it worth-
while, and, if so, at different spatial scales—regionally, nationally or globally? Consider that the mainland US has more than 100,000 miles of shoreline. (Global Perspective)

Learning Activity: Power Point Presentation

Class discussion of cost and benefits of various coastal engineering projects and viability based on differing oceanographic and socio-economic conditions in European countries and the Bahamas (Socratic Circles).

Assignment: One page summary of D2 reading and R2 chapter on Italy.

February 17 Erosion Hot Spots Article D2 & R2 on Italy

Engaging Question: What role do humans vs. nature play in causing severe erosion along our coastlines?

Learning Activity: Power Point Presentation

Group discussion of causes of erosion hot spots and possible mitigation strategies. (Global Engagement)

Assignment: Participate in Saturday field trip and prepare for Mid-Term Exam.

February 22 Saturday, day-long field trip to coastal erosion hot spots in Palm Beach and Broward Counties. Students will bring their cell phones or cameras to video areas that have experienced accelerated erosion and any mitigating measures; a short video (e.g., few minutes) can be made to promote public awareness. (Global Engagement)
Students are strongly encouraged to participate in the field trip; extra credit will be awarded for production of the video.

February 24  Mid-Term Exam

Assignment: One-page summary of D3 article and R3 on European case studies (Chapter 22).

March 3  Sand Rights and Fights Article D3 & European Cases

Engaging Question: Whose sand is it and what right does one group have to build structures that rob others of their fair share (e.g., “rob Peter to pay Paul”)? Just as there is a continuing debate regarding water rights on a global basis, such a conflict exists along many shorelines that span different towns, counties and nations. For instance, there has been a tremendous amount of beachfront development along the Spanish Mediterranean Sea in the past few decades, and now coastal engineering projects are underway to protect this valuable real estate where erosion is a problem.

(Global Awareness and Perspective)

Learning Activity: Power Point Presentation

Class Activity: Debate among teams regarding the sources of sand, causes of erosion both natural and anthropogenic and mitigation actions that result in narrow or absent beaches, making shorefront property vulnerable to coastal storms.

Assignment: Students will prepare videos and/or powerpoints.
March 10        Spring Break

March 17        Students will showcase their videos on erosion hot spots in class, which will include photos and clips from other highly erosional areas on a worldwide basis; this will engender considerable class discussion. (Global Awareness, Perspective and Engagement)

The best videos will be placed on You Tube.

Learning Activity: Power Point Presentation
Assignment: One page summary each of articles D4 and D5.

March 24        Politics of Shore Erosion        Articles D4 and D5

Engaging Question: Is it possible to make maps lie so that beaches can appear wider than they naturally are?

Learning Activity: Power Point Presentation

Class discussion of the case of Fire Island and Village of Westhampton Dunes along the South Shore of Long Island, New York regarding the placement of responsibility for erosion problems that resulted in tens of millions of dollars committed by the Federal Government in one case and the hopes of a similar decision by an adjacent beach community. (Socratic Circles).

Assignment: One page summary each of articles D6, D7 and on-line article on the case study of Sylt Island, Germany.
Engaging Question: Will the Outer Banks of North Carolina, consisting of a world-class foreland of three capes and barriers, break apart into relative small island segments during the next category 5 hurricane that strikes this area as proposed by some coastal scientists? Should savvy property owners sell their houses now, considering that their property may be the new “Atlantis” and ocean bottom is not developable?

Learning Activity: Power Point Presentation

Group discussion of the fundamental considerations for the preservation of barrier islands, which have persisted for thousands of years (albeit not in the same location), that may now be vulnerable to demise. What islands have already been lost or may disappear in the coming decades, such as the Chandelier Islands in Louisiana, and under what conditions does this wholesale loss of a coastal landscape occur for barrier islands worldwide, such as the island of Sylt, Germany? (Global Perspective)

Assignment: One page summary each of articles D8 & R4--case study of the old Roman city of Constanta on the Black Sea coast of Romania.

Engaging Question: When is it proper to take or deny the highest economic use of private property for the public good?

Learning Activity: Power Point Presentation
Class discussion of the Lucas vs. State of South Carolina wherein lower courts had ruled that the state had the right to deny a building permit for land too close to the water’s edge and other cases that involve the confiscation or impaired use of land, such as construction of interstate highways and other public good.

In other countries, there are different problems such as the usage of the best beaches in The Bahamas for resorts, such as Atlantis on Paradise Island, Nassau. In Costa Rica, there are often squatters on large tracks of land because of weak land ownership laws. Still elsewhere, some of the most magnificent coastlines, such as Nash Point, Glamorgan Heritage Coast in Wales, are located on private lands. While access points and trails through the pastures are provided, there is scant to no parking along the narrow lanes (e.g., trivet-bounded roads) that date back to Medieval times. In Constanta, Romania, construction of bars and restaurants on the public beach is unlawfully permitted by the city mayor.

Assignment: One page summary each of articles D9 and D10 on the Gold Coast of Australia.

April 14 Economic Values of Beaches and Cost of Preservation Article D9 & Gold Coast of Australia

Engaging Question: Are we protecting beaches or bedrooms—wherein lies the public good?

Learning Activity: Viewing of video “Restore the Shore” by the Surfriders Foundation (see www.surfrider.org) and Power Point
Presentation.

Group discussion of the cost of beach nourishment and other coastal engineering projects that each cost tens of millions of dollars to protect beachfront development. Considering global warming and on-going sea level rise, are beaches “Here Today; Gone Tomorrow” as proclaimed in some reports? What can we do to make a difference? (Global Engagement)

Assignment: Prepare for Final Exam.

April 21 Final Exam